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PATENT SPECIFICATION

Application Date: May 18, 1938. No. 14893/38. **514,917**

Complete Specification Left: April 21, 1939.

Complete Specification Accepted: Nov. 21, 1939.

PROVISIONAL SPECIFICATION

Improvements in or relating to Fluid Pressure Braking Systems for Vehicles

We, AUTOMOTIVE PRODUCTS COMPANY LIMITED, a Company incorporated according to British Law, of Brock House, Langham Street, London, W.1, and GEOFFREY ROBERT GREENBERGH GATES, a British Subject, of the Company's address, do hereby declare the nature of this invention to be as follows:—

This invention relates to fluid pressure braking systems for vehicles, and more specifically to braking systems in which air pressure is employed to provide the braking effort, the effort being transmitted to the wheel brakes through a liquid pressure system.

The air pressure is controlled by a valve actuated by the operator, and the object of the invention is to provide a system in which the operator is able to feel the degree of braking applied.

According to the invention the liquid pressure produced in the master cylinder of the brake system, is applied to a piston acting on the control member of the air inlet valve to oppose the pressure applied by the operator to open the valve.

According to one form of the invention, the liquid pressure acts on the air inlet valve in a direction tending to close the valve, and so operates through the valve on the control member.

In one arrangement of a braking system according to the invention, a liquid pressure master cylinder is mounted co-axially with an air pressure cylinder of larger area in which operates a piston carrying a thrust rod which acts on the piston of the liquid pressure master cylinder. The piston in the air pressure cylinder may be operated by the introduction of high pressure air behind it, or by the application of suction to the space in front of it, in which latter case it will be moved by the atmospheric pressure acting on its rear face.

In the example herein described, the piston is operated by compressed air supplied from a storage cylinder in which pressure is maintained by a compressor driven by the engine of the vehicle. The cylinder is closed at its rear end by a cover plate, integral with which is formed a valve block in which are mounted inlet and exhaust valves, both of which are operated by a rocker arm or arms pivotally mounted on the cylinder and coupled by linkages to a foot pedal.

The valves are arranged side by side in parallel chambers communicating by passages with the space in the air cylinder behind the piston. The air inlet valve comprises a spindle extending through the chamber into bearings at each end and slidably mounted in these bearings, the spindle being provided with an integral collar on one side of which is mounted a seating washer, of rubber, fibre or like material. A metal sleeve is fitted on the spindle with its end resting against the seating washer, and is held in place by a spring clip. The chamber in which the valve operates is formed partly in the valve block itself, and partly in a cover piece bolted thereto, a flanged sleeve being clamped by means of its flange between the valve block and the cover plate to divide the valve chamber into two parts. The sleeve mounted on the valve spindle is a sliding fit within the flanged sleeve, and is formed with tapered axial grooves which provide a passage between the two sleeves when the valve is open, the area of the passage being variable according to the relative positions of the sleeves. In the closed position of the valve, the seating washer bears against the end of the flanged sleeve, and shuts off entirely the passage of air from the space in the cover plate around the flanged sleeve, to which the supply pipe from the air reservoir is connected, to the passage in the valve block which leads to the cylinder. The valve spindle is packed at each end where it passes out of the chamber, one end of it projecting to be engaged by the rocker arm.

The exhaust valve is similarly formed by a collar on a sliding spindle carrying a seating washer. The washer in this case seats when the valve is closed on an annular face formed around an orifice in the wall of the valve block, the valve moving in a chamber in the cover plate and being guided therein. The cover plate of the exhaust valve is formed integral with the cover plate of the inlet valve,

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and is formed with an orifice by which the cylinder is connected, when the exhaust valve is open, to the atmosphere. The exhaust valve is urged away from its seat by a spring, and between its spindle and the operating rocker is provided a plunger, spring loaded relatively to the valve, which permits movement of the rocker arm after the exhaust valve has become closed. The plunger may take the form of a sleeve surrounding the valve spindle.

In line with the inlet valve spindle, a cylinder is formed in the valve block, in which is mounted a piston secured to or bearing against the end of the valve spindle. This cylinder is connected by piping to the liquid pressure master cylinder, pressure in which tends to urge the valve towards the closed position. A spring in the cylinder holds a cup washer against the piston, and also serves to hold the valve closed.

The operation of the braking system is as follows:—

With the brakes off, the inlet valve is closed, and the exhaust valve open, the inlet valve being held on its seat by the spring in the hydraulic cylinder attached to it. To apply the brakes, the operator depresses the pedal, thereby first closing the exhaust valve against its spring, and then opening the inlet valve to admit compressed air to the cylinder. The compressed air acts on the piston in the air cylinder, and thus applies pressure through the thrust rod to the piston of the liquid pressure master cylinder.

The pressure produced in the liquid pressure master cylinder acts in wheel cylinders associated with the brakes on the several wheels of the vehicle to apply the brake shoes to the drum, and also acts on the piston in the cylinder formed in the valve block, to apply a thrust to the inlet valve spindle tending to close the valve. This thrust is transmitted through the inlet valve spindle and linkage to the foot pedal, and thus the operator is able to feel the amount of pressure which is being applied to the brakes, and can readily apply the brakes in a smooth and steady manner.

It is not essential that the liquid pressure should react on the foot pedal through the inlet valve. If preferred, the cylinder in which the liquid pressure acts may have its piston coupled directly to the linkage between the valve and the pedal, the inlet valve being provided with a return spring to move it to the closed position.

The braking system according to the invention may be operated by a hand lever instead of a foot pedal, depending on the type of vehicle to which it is applied.

Dated this 18th day of May, 1938.

For the Applicants,
F. J. CLEVELAND & COMPANY,
Chartered Patent Agents,
29, Southampton Buildings,
Chancery Lane, London, W.C.2.

COMPLETE SPECIFICATION

Improvements in or relating to Fluid Pressure Braking Systems for Vehicles

We, AUTOMOTIVE PRODUCTS COMPANY LIMITED, a British Company, of Brock House, Langham Street, London, W.1, and GEOFFREY ROBERT GREENBERGH GATES, a British Subject, of the Company's address, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to fluid pressure braking systems for vehicles in which air pressure is employed to provide the braking effort, the effort being transmitted to the wheel brakes through a liquid pressure system, and more specifically to braking systems of the kind in which the air pressure, which is applied to a piston or diaphragm mechanically connected to the piston of a liquid pressure master cylinder, is controlled by an air inlet valve actuated by the operator. The object of the invention is to provide a system in which the operator is able to feel the degree of braking applied.

According to the invention the pressure produced in the master cylinder of the liquid pressure system, is applied to a piston acting on the control member of the air inlet valve to oppose the pressure applied by the operator to open the valve.

According to one form of the invention, the liquid pressure acts on the air inlet valve in a direction tending to close the valve, and so operates through the valve on the control member.

The invention is hereafter described with reference to the accompanying drawings in which:—

Figure 1 is an end elevation of the operating unit of a braking system according to the invention;

Figure 2 is a side elevation of the unit shown in Figure 1, being in part a section on the line 2—2 of Figure 1;

Figure 3 is a section on the line 3—3 of Figure 1; and

Figure 4 is a detail section on the line 4—4 of Figure 3.

In the arrangement illustrated in the drawings, a liquid pressure master cylinder 10 is mounted co-axially with an air pressure cylinder 11 of larger area, and a piston 12 slidably mounted in the cylinder 11 carries a thrust rod 13 which acts on the piston 14 of the liquid pressure master cylinder 10. The piston 12 in the air pressure cylinder 11 is, in the arrangement illustrated, operated by the introduction to the space 15 of high pressure air, but it may alternatively be operated by the application of suction to the space 16 in front of it, in which latter case it will be moved by the atmospheric pressure acting on its rear face.

In the example herein described, the piston 12 is operated by compressed air supplied from a storage cylinder in which pressure is maintained by any convenient means, as by a compressor driven by the engine of the vehicle. The cylinder 11 is closed at its rear end by a cover plate 17, integral with which is formed a valve block 18 in which are mounted inlet and exhaust valves (see Figures 2 and 3), the valves being operated by rocker arms 23 and 24 formed integral with a sleeve 25 pivotally mounted in brackets 26 formed on the cover plate 17, a third arm 27 on the sleeve 25 being coupled by linkage 28 to a foot pedal.

The two valves are arranged side by side in parallel chambers, communicating by passages 31 and 32 with the space 15 in the air cylinder 11 behind the piston 12. These valve chambers are formed partly in the valve block 18 itself, and partly in a cover member 33 bolted to the valve block, the inlet valve chamber having in it a flanged sleeve 34 the flange 35 of which is clamped between the valve block and cover member, sealing rings 36 being provided to ensure a fluid tight joint. The inlet valve comprises a rod 37 on which is formed a disc 38 on one face of which is mounted a sealing washer 41 of rubber, fibre or like material, and a metal sleeve 42 mounted on the spindle with its end resting against the washer 41, the sleeve being held in place by a spring clip 43. The sleeve 42 is a sliding fit in the flanged sleeve 34, and is formed with tapered axial grooves 44 which provide a passage between the two sleeves when the valve is open, the area of the passage being variable according to the relative positions of the sleeves. In the closed position of the valve the sealing washer 41 bears against the end of the flanged sleeve 34, and shuts off entirely the passage of air from the space 45 in the cover member around the flanged sleeve 34, to which the supply pipe 46 from the air reservoir is connected, to the space 47 in the valve block, and the passage 31 leading therefrom to the cylinder 11. The inlet valve is operated by the rocker arm 23 through a tappet member 48 having a limited range of movement relative to the valve rod 37, a spring 51 being inserted between the rod and the tappet. The relative movement of the rod 37 and tappet 48 is limited by a pin 52 carried by the latter and sliding in a slot 53 in the former, and the escape of air along the rod 37 is prevented by a packing 49, held in position by a screw plug 50. At its end remote from the tappet 48 the rod 37 is recessed to receive a spigot 54 on the end of a piston 55 sliding in a cylinder 56 co-axial with the valve chamber, a packing washer 57 being mounted between the end of the rod 37 and the piston 55.

The exhaust valve is similarly formed by a collar 58 on a sliding spindle 59, the collar carrying a sealing washer 60. The washer 60 in this case seats when the valve is closed on an annular face 61 formed around an orifice 62 in the wall of the valve block 18, the valve moving in a chamber 63 in the cover plate 33 and being guided therein. An orifice 64 in the cover plate 33 connects the cylinder 11, when the exhaust valve is open, to the atmosphere. The exhaust valve 58 is urged away from its seat by a spring 65, and its spindle 59 telescopes into a tappet 66 sliding in the cover plate 33, the tappet engaging an adjustable abutment screw 72 on the operating rocker arm 24, and having mounted between it and the valve spindle 59 a spring 67 which permits movement of the rocker arm after the exhaust valve 58 has become closed. A similar adjustable abutment screw 73 is provided on the inlet valve operating arm 23.

The cylinder 56 co-axial with the inlet valve rod 37 is formed in the valve block 18 and is connected by piping 68 to the liquid pressure master cylinder 10, pressure in which tends to urge the valve towards the closed position. A spring 69 in the cylinder holds a cup washer 71 against the piston, and also serves to hold the valve closed.

The operation of the braking system is as follows:—

With the brakes off, the inlet valve is closed, the washer 41 being held against the end surface of the sleeve 34 by the

spring 69, and the exhaust valve is held open by the spring 65. To apply the brakes, the operator depresses the pedal, thereby actuating the linkage 28 to move the lever mechanism 23, 24, 27. The tappet 66 is held in contact with the lever 24 by the spring 65, whereas the tappet 48 of the inlet valve has its end spaced from the lever 23. The initial movement of the pedal thus closes the exhaust valve against the spring 65, the latter having a lower rate than the spring 67 and subsequently opens the inlet valve to admit compressed air to the cylinder 11. The compressed air acts on the piston 12 in the air cylinder 11, and thus applies pressure through the thrust rod 13 to the piston 14 of the liquid pressure master cylinder 10.

The pressure produced in the liquid pressure master cylinder 10 acts in wheel cylinders associated with the brakes on the several wheels of the vehicle to apply the brake shoes to the drum, and also acts on the piston 55 in the cylinder 56 to apply a thrust to the inlet valve rod 37, tending to close the valve against the spring 51, and thus to limit the application of the brakes to a degree dependent on the movement of the foot pedal. This thrust is transmitted through the inlet valve rod 37, spring 51, tappet 48 and linkage 28 to the foot pedal, and thus the operator is able to feel the amount of pressure which is being applied to the brakes, and can readily regulate the degree of braking applied, and apply the brakes in a smooth and steady manner.

It is not essential that the liquid pressure should react on the foot pedal through the inlet valve. If preferred, the cylinder in which the liquid pressure acts may have its piston coupled directly to the linkage between the valve and the pedal, the inlet valve being provided with a return spring to move it to the closed position.

The braking system according to the invention may be operated by a hand lever instead of a foot pedal, depending on the type of vehicle to which it is applied.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A fluid pressure braking system of the kind referred to, wherein the pressure produced in the master cylinder of the liquid pressure system is applied to a piston acting on the control member of the air inlet valve to oppose the pressure applied by the operator to open the valve.

2. A fluid pressure braking system of the kind referred to, wherein the liquid pressure produced in the master cylinder acts on the air inlet valve in a direction tending to close the valve, and so operates through the valve on the control member.

3. A fluid pressure braking system according to Claim 1 or 2, wherein the air inlet valve comprises a collar mounted on a rod and engaging a seating at the end of a sleeve, and a cylindrical member carried by the rod and slidable in the sleeve, said cylindrical member having a plurality of tapered longitudinal grooves on its external surface.

4. A fluid pressure braking system according to Claim 3, wherein the valve is opened by a manually controlled rocker arm, and is closed by a spring.

5. A fluid pressure braking system according to Claim 4, wherein the valve rod abuts against a piston in a cylinder connected by piping to the liquid pressure master cylinder, pressure in the said cylinder tending to close the valve.

6. A fluid pressure braking system according to any preceding claim, wherein an inlet and an exhaust valve are mounted side by side in a housing carried by the air pressure cylinder.

7. A fluid pressure braking system according to Claim 6, wherein the inlet and exhaust valves are operated by a common manual control member.

8. A fluid pressure braking system constructed, arranged and adapted to operate substantially as described with reference to the accompanying drawings.

Dated this 21st day of April, 1939.

For the Applicants,
F. J. CLEVELAND & COMPANY,
Chartered Patent Agents,
29, Southampton Buildings,
Chancery Lane, London, W.C.2.

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[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 2.

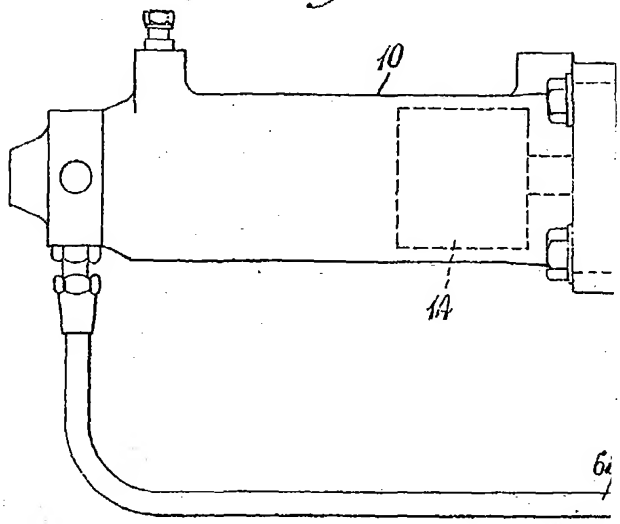


Fig. 1.

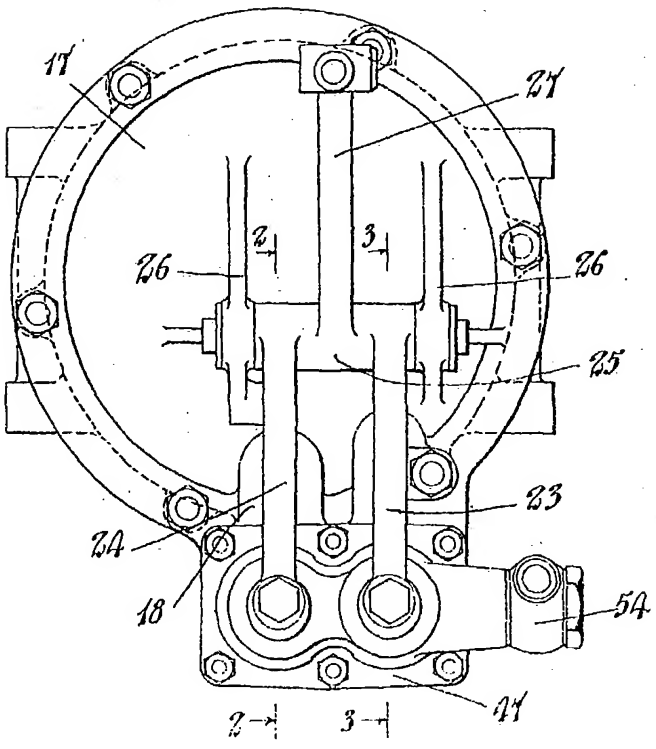


Fig. 4.

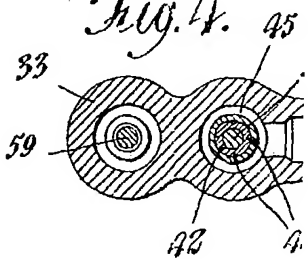
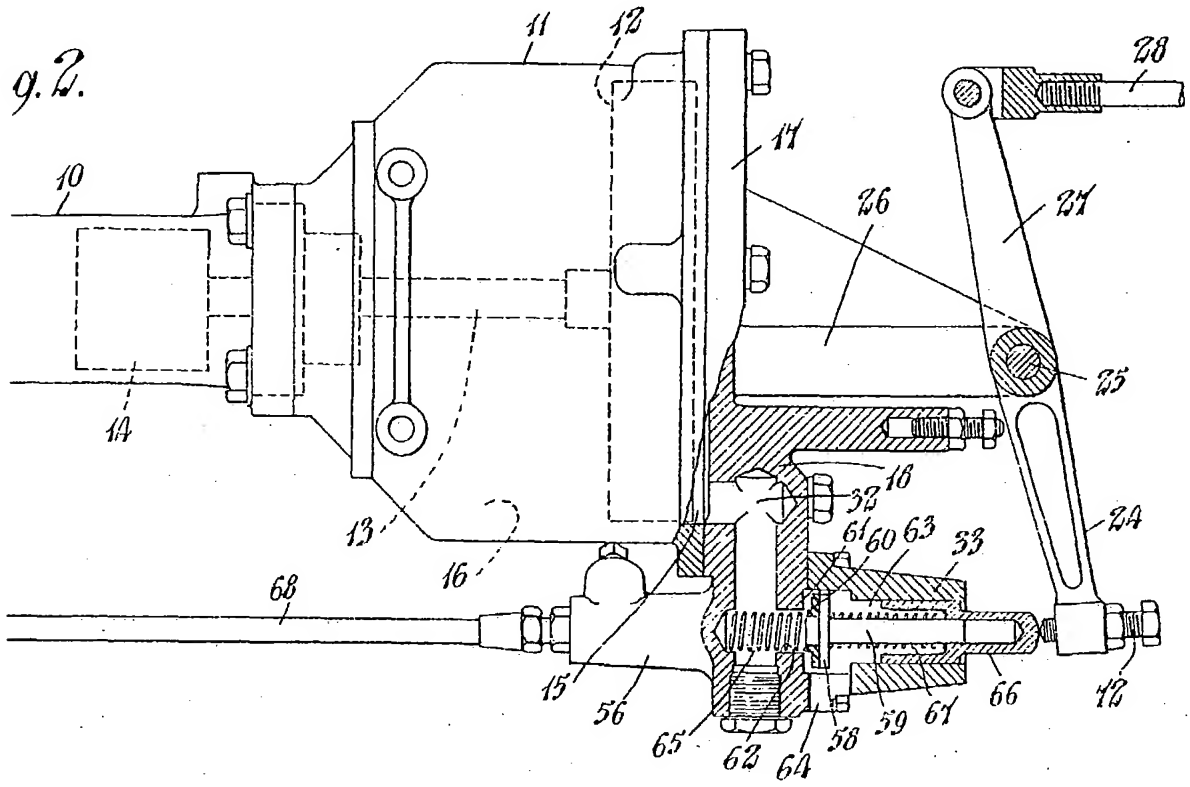


Fig. 2.



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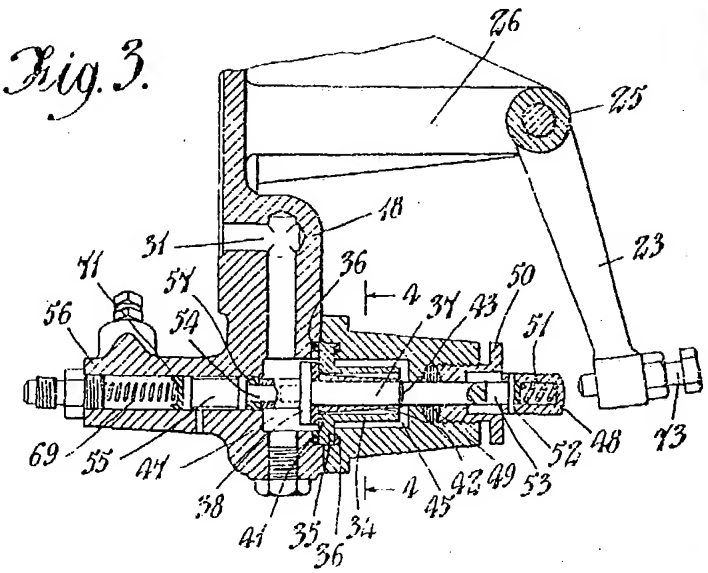
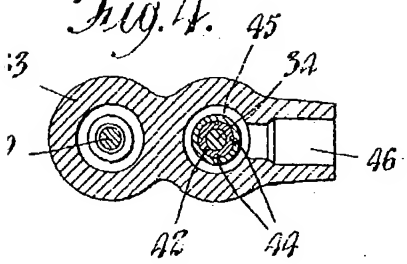


Fig. 4.



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514,917 COMPLETE SPECIFICATION

1 SHEET

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Fig. 2.

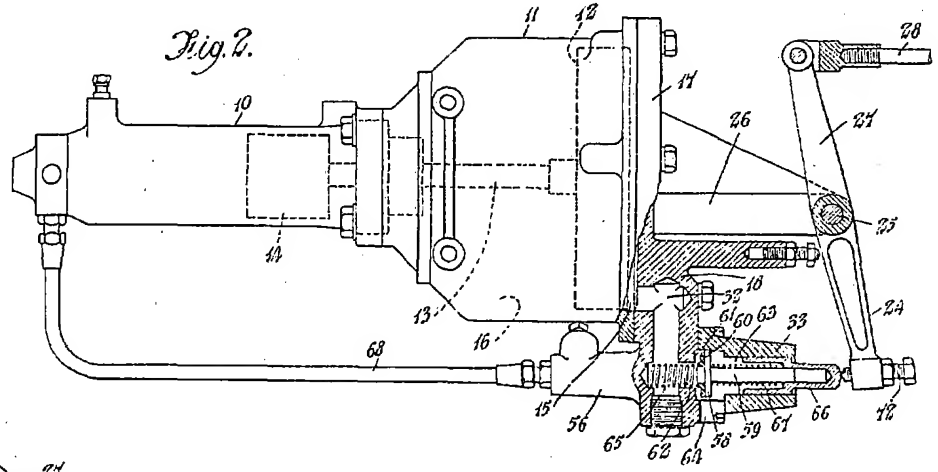


Fig. 1.

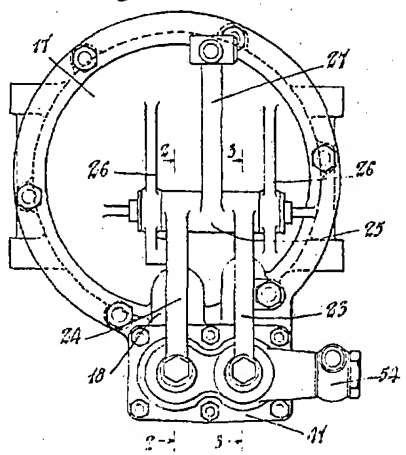


Fig. 4.

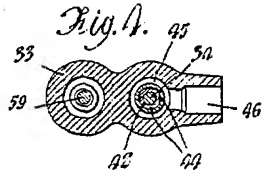
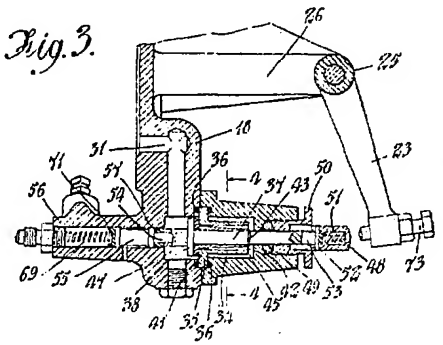


Fig. 3.



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